APSC 143 – Introduction to Programming for Engineers

Assignment 4 – Repetition Statements

Figure 1: Financial Accounting.

Objective:

In this assignment, you will use programming to help you determine whether to invest in a project. You will use repetition statements and previous course topics to create a program to accept an input of the economic values of an Engineering project. You will use these values to determine the *economic feasibility* of the project (i.e., is it profitable?) as well as determine the *payback period* for the project. This assignment will also aid you in determining economic feasibility in your APSC101 project.

Background:

A basic economic project involves an **initial cost**, an **annuity**, and **interest rate**, and a **project lifespan**.

- Initial Cost: What is paid to build/begin the project at "year 0" of the project's lifespan. (The investment).
- Annuity: A constant sum of money that is paid/received every year.
- Interest rate: Money paid to the investors for the use of their assets.
- Project lifespan: The number of years that a project is active and generating revenue.

For example, consider that you are part of a company that is looking to replace a machine in their manufacturing line to improve efficiency, but requires a large upfront cost. To determine if the new machine should be purchased, you must look at the upfront cost of the part in relation to the increase in profits it will provide over the active time of the machine. A diagram outlining the gains or losses associated with purchasing this new part can be seen in Figure 2. This can be used to estimate the cost of the project's total gains or losses.
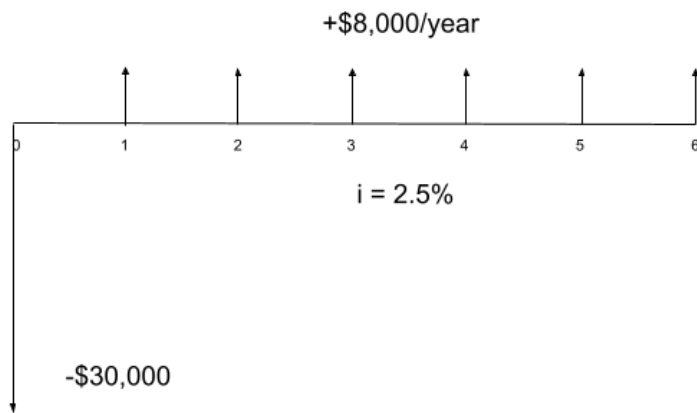
Figure 2: Cash Flow Diagram Example - $30000 initial cost, $8000 annuity, 2.5% interest for a 6-year project.

The complication with cost estimation is a compound interest rate, which is an interest rate than grows exponentially each year (think inflation). This devalues future revenues more the further into the future they are. To analyze the economic feasibility of a project, all cash values need to be converted to a "common year". We will use the present time (year 0) as this common year.

To convert from a future value of money (FV) to its equivalent present value (PV), use the equation below. i is the interest rate, and n is the number of years into the project

$$FV = PV(1 + i)^n$$

$$PV = \frac{FV}{(1 + i)^n}$$

Once all values are converted, they can be added to find the present value of the project. If the present value is greater than $0, The project is *economically feasible* and should be pursued.

A **payback period** is the amount of years it takes for a project to pass the $0 threshold and become profitable.

- For an economoically feasible project, the payback period will be **less** than the project lifespan
- For a non-economically feasible project, the payback period will be equal to or **more** than the project lifespan

In APSC101's Week 5 content, this topic is covered in further detail.

Instructions:

Below is a guideline for how to approach this problem, though you may choose to approach it however you wish. **Make sure to express your results using the format specified below**:

- Declare variables to user for user input for the economic data of the project. Ask for and collect input from the user, and store that data in these variables.
- Use a loop to determine the equivalent "Present Value" of the project using the equation above.
- Print the Present Value result to the console, as well as the feasibility of the project.
- Use a loop to determine the payback period of the project and print this result to the console.

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Comments are mandatory for this assignment. Add comments as necessary for key pieces in your code, such as variable declaration, conditional statements, and looping conditions to explain what the program is doing.

Your output must match the sample output below exactly; otherwise, the auto grading software will not be able to grade your assignment, which may affect your mark.

Example Output:

(Note: You **DO NOT** need to print the values in bold; they are shown only to display the **scanf** input for this example. **Note that the '$' in the input statements is not bolded.**)

(Note: Make sure that and that the last line also prints a new line for Gradescope to give full credit.)

Below is an example of an economically feasible project:

```
Enter the initial cost of the project: $30000

Enter the annuity of the project: $8000

Enter the interest rate in %: 1.25

Enter the lifespan of the project in years: 5

Present worth of the project = $8542.68

The project is economically feasible.

The payback period for this project is 4 years.
```

Below is an example of a non-economically feasible project:

```
Enter the initial cost of the project: $100000

Enter the annuity of the project: $12000

Enter the interest rate in %: 5

Enter the lifespan of the project in years: 10

Present worth of the project = -$7339.18

The project is not economically feasible.

The payback period for this project is 12 years.
```

Submission Instructions:

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Create your program using CLion and upload it here for grading. **Your program file must be named** "**apsc143assign4.c**" in order for your assignment to be graded. Do not include any personal information (student number, name, etc.) in your submission. If you have consulted any resources to complete your work, indicate those resources in your comments. Also, include in your comments that you attest to the originality of your work.

Refer to the assignment rubric on OnQ for a detailed breakdown of the grading criteria. Your submission must adhere to the assignment rules as outlined in the submission policy document for this course, which can also be found on OnQ. There is zero tolerance for plagiarism in this course. This auto grading software will automatically flag potential cases of plagiarism, which will be reviewed by the instructors.

More information on assignment submissions can be Found in Week 2, and information on the specific definition and repercussions of plagiarism can be found in the "Begin Here (About This Course)" module.